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HABITS OF PERDITA ZEBRATA WITH DESCRIPTION OF LARVA.

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It is during the month of August that one can find the wild bee, *Perdita zebrata*,[1] nesting in the sandy soil at White Rocks near Boulder, Colorado. The nests are usually found together in groups of eight to ten, one female to a nest. Those studied last summer were located in a sandy field sloping to the south at the base of the cliffs.

Each nest is surmounted by a small mound of dark soil an inch or so in diameter. It is interesting to note that this is placed to one side of the entrance as a result of the small angle which the main tunnel bears to the surface of the ground. The males are not usually present in the vicinity of the nests; the females are seen only with some difficulty since they are scarcely a quarter inch long, possess dark and light banded abdomens and are swift in their flight. When the female approaches the nest, she often darts to a position a few inches above the entrance where she hovers for a moment flying back and forth sideways with great rapidity before she drops suddenly to within a few mm. of the opening and enters. As in the case of *Perdita opuntiae*, when the entrance is occluded, as is often the case, the female inserts her head into the opening and makes her way down through the sand which closes behind her. She clears the way later by backing up the tunnel thus pushing the sand out with her abdomen.

Like the great majority of the bees of the genus *Perdita*, this member is apparently limited to a single species of plant, *Cleome serrulata*, for its supply of pollen and nectar. The means by which it collects the pollen is interesting: The flowers of the plant are arranged in clusters with long, thin, widely separated stamens fully one half inch long with the anthers curled up on the end. Since the bee is only one quarter inch in length it can not reach the pollen from a petal of the flower; hence it must climb up the stamen. It does this in one of two ways: Either it alights first on a petal and then ascends, or, as is usually the case, alights half way up the stamen pulling itself up to the anther from there. Then it rests above the anther, which is in contact with its ventral surface, and scrapes the pollen back with the fore and mid legs to deposit it as a nodule on each of the hind femora. Here the mass takes on a distinctly greenish color. The bees reach the nectar by inserting their heads down between the petals and stamens and then extending their long tongues. The plants are usually to be found within twenty to fifty yards of the colonies.

There are usually two or three entrances to a nest. The tunnels from these often join one another after a distance of 5 or 10 cm. and then the main passage proceeds downwards until it reaches a depth of 10 to 15 cm. At first

1.—Determined by Mr. P. H. Timberlake. *P. zebrata* is the type of a subgenus *Neoperdita* Ashmead.

the tunnel runs almost parallel with the surface of the ground for 8 to 10 cm. and then usually turns abruptly about to descend more rapidly in a different direction. When it reaches a depth of 5 to 10 cm., it usually assumes a more vertical route and then suddenly branches out in all directions, each gallery ending in a cell. By this means a group of five to eight cells is formed within an area of 10 cm.

From this description the nest is seen to have certain characters in common with that of *Perdita opuntiae,* namely that there are two or more entrances the tunnels from which meet at varying distances beneath the surface. But in case of *Perdita zebrata* the cells occur at the ends of tunnelways in groups of five to eight, and the wall of tunnel and cell is rough being of the same color as the surrounding soil; while in *P. opuntiae,* which nests in stone, the cells are placed at irregular intervals in the passageway itself, sometimes numbering over two hundred and the wall of tunnel and cell is smooth being covered by a dark mud-like material. In the nest of *Perdita zebrata* there is usually just one inhabitant; in that of *Perdita opuntiae* there are sometimes as many as fifteen.

The cell of *Pedita zebrata* is oval and about 7 mm. in length. When completed it contains the egg, one end being inserted into a pollen ball 2 mm. in diameter. The larva first starts to eat at the top of this pollen ball; later, however, it descends underneath so that it lies on its back with the pollen on its ventral surface on top of it. This keeps the pollen moist by isolating it from the hygroscopic walls of the cell. Hence, when the nest is dug up, all the larvae will be found to be lying on their backs in the cells.

In one nest, at a depth of about 4 cm., I was surprised to find an actively moving pupa. I was not able to repeat this finding in any other nest during the rest of the summer. It is difficult to give the correct explanation; apparently it indicates that there are two broods of this species each summer. However, this pupa might have been one of last year's larvae which was much slower to develop than others; or on the other hand it might have been one of those that had transformed into the pupal state with abnormal rapidity. Further investigation would be of interest.

The larva of this species has a few very characteristic features serving to distinguish it from others of different species that have come to my attention: From those of *Perdita opuntiae* and *Spinoliella australior* it is distinguished by the long median posterior spine and the brown bristles at the tips of the dorsolateral spines. One cannot tell just what characters are important until he has studied the larvae of more species. The following is a brief description of the larva of *Perdita zebrata*:—

Length 9 mm. around greater circumference; cream color with some slight ochreous pigment on tips of dorsolateral spines; general form semi-circular, the anterior and posterior ends approaching one another: segments easily told from one another, each with a pair of spines and of ochre edged spiracles; anterior end small with sharply pointed, brown tipped mandibles not coming into contact with one another; an elevated area dorsal to base of each mandible; two rows of dorsolateral spines, 11 or 12 on each side, the longest on the middle segments about 2/3 mm. in length, the base broad but rapidly narrowing to 1/5 the length,

the sides of distal half almost parallel and ending in a slightly knobbed extremity; rows of spines 1.5 mm. apart as measured from apex of one spine across to apex of the one opposite; apex of spine flattened and somewhat knob-shaped with 4 to 12 dark brown, pointed bristles which are mainly around the circumference of the flat area, are longest on the middle spines and only easily visible under the low power of the microscope; surfaces of spines concave outwards; dorsum of posterior end occupied by a median spine at least twice as long as the others.

The larva of *Perdita opuntiae* lacks the median spine and the bristles on the dorsolateral spines. Other points of difference are: Color more yellowish; dorsolateral spines shorter, the longest about .5 mm. in length, their sides not concave outwards nor so constricted distally, the apices more rounded and gleaming without bristles; diameter of spiracles hardly one-half as great.

The larva of *Spinoliella australior* also lacks median spine and bristles and differs from *Perdita zebrata* in the following ways: Dorsolateral spines shorter, stouter, triangular in shape, the sides of the distal portion not constricted to be almost parallel but uniformly converging distally without knob formation; diameter of spiracles hardly one-half as great.

From these descriptions it is plain that the larvae of *Perdita opuntiae* and *Spinoliella australior* are much more similar to one another than to that of *Perdita zebrata*. Further comparisons ought to be made with other *Perdita* larvae. If all the latter were found to possess the median spine, this character, I should think, would be further evidence for the consideration of *Perdita opuntiae* as belonging to a different genus (*Lutziella* Ckll.).

Perdita opuntiae possesses the following characteristics serving to distinguish it from *Spinoliella australior*: Color more yellowish sometimes with reddish pigmentation, especially anteriorly; spines shorter, wider, more nipple-shaped, their sides more convex outwards, their bases surrounded by more distinct grooves, the tips usually deficient in the brown patch of ochreous pigment; mandibles much smaller.

LABORATORY BREEDING OF THE EUROPEAN CORN BORER (*PYRAUSTA NUBILALIS* HUBN.) WITH SPECIAL REFERENCE TO EQUIPMENT AND CAGES.

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During the last three years considerable time has been devoted to the development of a technique for rearing larvae of the European corn borer, *Pyrausta nubilalis* Hubn., in quantity. This work was necessary for the breeding of parasites working on the first instars of the borer, such as, *Microgaster tibialis* Nees which has been reared successfully during the last two years, *Eulimneria crassifemur* Thom., *Macrocentrus gifuensis* Ashm., and *Apantetes thompsoni* Lyle, work with the last three species being still in the experimental stage. Though large numbers of larvae can be produced by employing the methods outlined in this paper further experiments are in progress with a view to reducing the larval mortality, particularly in the second and third instars.

All material is incubated at a temperature of 85 degrees F. with a relative humidity of 60 per cent. or higher. This has been found to provide optimum conditions for propagation.

PUPATION CAGE

Since all the young larvae reared in the laboratory are used in the parasite breeding, full-grown larvae collected in the field are used to rear moths for egg production. The cages that are now used for this part of the work have proven to be very satisfactory and are, at the same time, very simple. They consist of lantern globes closed at both ends with fine mesh wire screening to facilitate the air circulation, and strips of corrugated cardboard one inch wide, which are placed side by side in a single row across the diameter of the globes

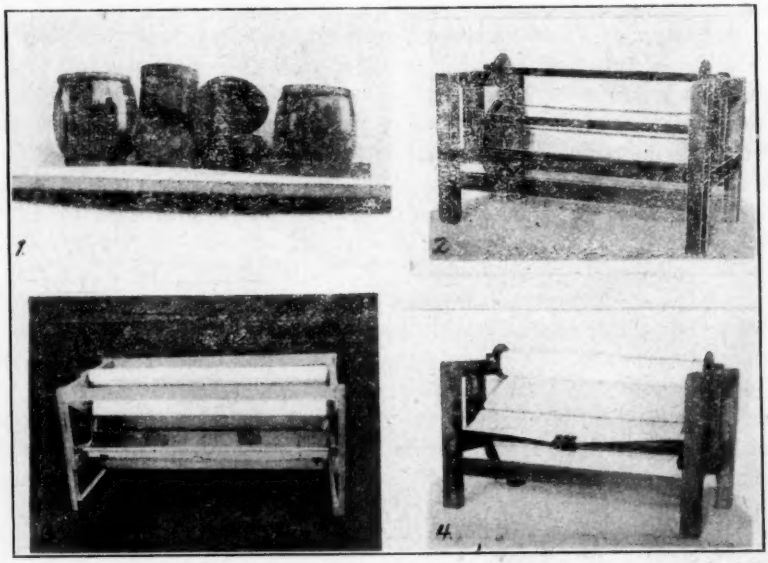


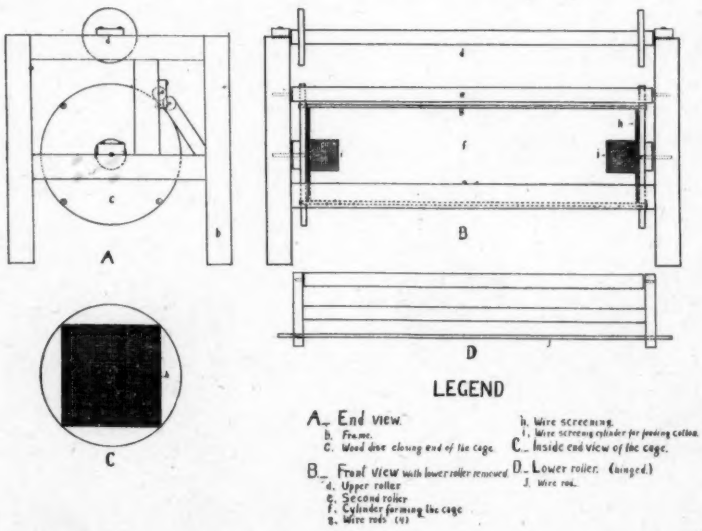
Fig. 1. Pupation and feeding cages. Fig. 2. Oviposition cage with wax-paper removed. Fig. 3. Large size oviposition cage. Fig. 4. Oviposition cage with wax-paper in place.

so that they form a partition. (See Fig. 1). The borers are put into the globe and crawl into the corrugations, which open to the sides, where they remain to pupate. Not more than two hundred larvae should be put in each cage. Before being placed in the incubator the globes and their contents are immersed in water for from five to ten seconds. All excess water is drained off and the water absorbed by the cardboard supplies sufficient moisture for pupation. During the time of incubation it is necessary to look the material over two or three times a week and remove the few dead larvae which would otherwise contaminate the healthy ones. The mortality among larvae varies between five and ten per cent. When overwintered larvae are used the moths begin to emerge in three weeks' time, but, if using fresh larvae collected during late summer and fall a much longer period of incubation is required. Emergence extends over a period

of about two weeks, the moths being picked out daily and placed in oviposition cages.

OVIPOSITION CAGE

Several types of cage for oviposition had been used with more or less satisfaction until the beginning of the year 1927, when a new type was made which has been used ever since with the best results. Details of the construction of this cage are shown in the figure. It consists of a cylinder twelve inches long and five inches in diameter suspended in a small frame, (A, b), in a horizontal position by means of a central axle on which it revolves. The frame also supports a series of three rollers which hold the waxed paper in place. The cage is so constructed that its sides,which represent the greatest surface, are of waxed paper. The ends of the cage, (A, c), are made of two discs of laminated wood one-quarter of an inch thick and five inches in diameter held apart by four stiff wires, (B, g), and when the waxed paper is placed around the wires it forms an oblong cage, twelve inches long by three and one-half inches square. The ends, which expose the smallest surface, are covered with wire screening, (C and B, h), in order to keep the moths from laying eggs on that part of the cage.



They are also provided with a wire screen cylinder, (B, i), one inch long and one inch in diameter to hold a feeding cotton which is kept moistened with water When putting paper on the cage a roll of waxed paper is placed on the top roller, (B, d), the paper is then passed over the second roller, (B, e), run around the wires and brought out over the lower roller, (D), the loose end being held in place by a clip to the wire rod, (D, j). It is so arranged that the paper containing egg masses is pulled out and replaced in the same operation. The lower roller, (D), which is hinged and removable, serves as a door to the cage. When opened it gives an opening two inches and a half wide, and, when closed against the second roller the distance between them is just enough to let the egg masses on

the waxed paper go through without being crushed.

As previously stated, the newly emerged moths are picked from the globes every day and put in the oviposition cages. The operation requires a light which is placed on the side opposite to the opening of the cylinder so that the moths, which are positively phototropic to artificial light, are held in the cylinder by the light through the wax paper and very few fly out. About forty females and thirty males are put in each cage. If kept in the incubator the females begin to lay in four or five days after emergence and they live from ten to twelve days. The dead moths are taken out of the cage every day and replaced by newly emerged ones. Since the moths are more active in the dark it is necessary to cover the cage with a heavy, dark paper. Seven of these cages are used to obtain our supply of eggs and, being even in size, they are piled up one on top of the other so that they occupy very little space in the incubator.

Owing to an extra supply of eggs being needed this summer for experiments in connection with conservation in cold storage a larger cage, (figure 3), was built on the same principle and has proven equally satisfactory. Its cylinder measures thirty-six inches in length by fifteen inches in diameter and has a capacity of 1,500 moths.

HATCHING AND FOOD MATERIAL

The eggs are taken out of the oviposition cages every morning and left in the incubator two or three days until they are ready to hatch, then they are cut from the paper and placed in 4-inch flower-pot saucers with food, (See Fig. 1). To make a container, one saucer is inverted on another and, in order that they fit closely, their edges are ground until an even surface is obtained. Before being used the saucers are immersed in water for twenty-four hours; this method has proven to be satisfactory since a large quantity of water is absorbed by the pottery which supplies sufficient moisture for the hatching of the eggs. Twenty egg masses are put in each container with food and then the containers are placed in the incubator. They are kept in the incubator until the larvae have reached the proper stage for parasitism, which takes about four or five days. During that period it is necessary to examine them daily and replace food material when it begins to decay.

After the third instar it is necessary to isolate the larvae on account of their cannibalistic habits. They are, therefore, fed in two-inch glass vials, wire screen stoppers being used in order to provide for ventilation.

A large number of foods have been experimented with including the following: curled dock, (*Rumex crispus*), string beans, (yellow and green pod), celery, corn, beet, turnip, rhubarb, apple, cabbage, chard, potato, corn flakes, lima bean, and sprouted grains. Of these, the first named have proven most satisfactory and in the order given.

NEW COLEOPTERA XIII.

BY H. C. FALL,
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Monocrepidius ferruginosus n. sp.

Elongate, entire body and antennae ferruginous, legs a little paler; pubescence very short, yellowish gray, lustre dull from the density of the punctuation.

Head nearly as wide as the prothorax, densely punctate, feebly broadly impressed. Antennae slender, passing by one or two joints the hind angles of the thorax, 3rd joint slightly longer than the 2nd, these together subequal to the 4th.

Prothorax ⅓ longer than wide (exclusive of the hind angles), sides nearly straight and subparallel or but feebly diverging toward the rear, hind angles divergent; surface densely subequally punctate except that the punctures on the posterior declivity and generally near the margins are smaller than those on the disk; hind angles with a fine carina, which viewed from above is quite near the side margin; a very short inner rudimentary carina is visible at the extreme apex.

Elytra 2 2/3 times as long and evidently wider than the prothorax; striae and strial punctures moderate, intervals nearly flat, numerously punctate, the punctures toward the base becoming subgranulose.

Beneath closely, finely, evenly punctate and pubescent, the punctures of the prosternum a little coarser anteriorly. The lobe of the 4th tarsal joint is very short, subtriangular, and almost or quite concealed from above.

Length 9-10.5 mm.; width 2.3-2.9 mm.

Arizona Baboquivari Mts. (Poling); Oracle 10.7 (Schwarz).

The type is from the first named locality.

Closely allied to *athoides* but probably always separable by its pale ferruginous color, and possibly by its rougher elytral intervals. None of the specimens at hand show any inflation of the prothorax such as is exhibited by females of *athoides*, but it may be that my five specimens of *ferruginosus* are all males.

Monocrepidius delicatus n. sp.

Elongate, entirely flavotestaceous except for a fuscous sutural stripe extending from the base to about the apical fifth and dilated behind the middle; pubescence fine, short, pale yellow; surface scarcely shining.

Head more than 2/3 as wide as the prothorax, finely closely punctate. Antennae slender, passing the hind angles of the thorax, joints 2 and 3 small, nearly equal, each very little longer than wide, and together shorter than the 4th.

Prothorax before the hind angles just perceptibly wider than its length along the median line; sides feebly arcuate and moderately convergent anteriorly, a slight sinuation before the base angles, which are not everted; surface moderately convex, very finely and closely punctate.

Elytra 2½ times as long as the prothorax; striae fine, moderately strongly punctate anteriorly, more finely so behind; intervals flat, finely punctate. The sutural stripe is parallel sided and occupies the first two interspaces as far as the middle, thence dilated to occupy the first four interspaces. Body beneath finely closely punctate and pubescent.

Length 5.75-6.5 mm.; width 1.6-1.9 mm.

Southern Arizona. Nogales viii.-12-06 (Nunenmacher); Baboquivari Mts. (Poling). One example from each locality, the latter taken as the type.

This species is most nearly related to *vespertinus*, but is smaller and with somewhat different elytral marking. It differs from all our previously described species by the very small and virtually equal 2nd and 3rd antennal joints, which are together shorter than the 4th joint. It is most nearly approached in this respect by *xysticus*.

Monocrepidius difformis n. sp.

Moderately elongate, subdepressed, fuscous brown, the sides of the prothorax diffusely fulvescent, especially about the front and hind angles, the alternate interspaces of the elytra with more or less interrupted paler vittae; antennae and legs pale; surface scarcely shining; pubescence short, inclined, dull yellowish.

Antennae slender, 2nd joint barely perceptibly shorter than the 3rd, these together a little longer than the 4th.

Prothorax across the hind angles 2/7 wider than the length along the median line, sides straight and parallel for a short distance at base, thence moderately convergent and but little curved nearly to apex; surface with a dual system of punctures, the larger punctures separated by about their own diameters; hind angles not at all divergent at apex, with a single acute carina which is about 1/3 the length of the side margin.

Elytra at base as wide as the thorax, sides feebly convergent in basal three-fourths; striae moderate, finely punctate, interspaces flat, finely not densely punctured.

Beneath fuscous, sides of propleura narrowly pale. Prosternum shining, sparsely punctate in front, closely so posteriorly with large and small punctures intermixed, a marked tumidity each side back of the anterior lobe. Parapleura more finely and densely punctate, the metasternum and ventral segments still more finely so. Lobe of 4th tarsal joint wider than the 5th joint.

Length 6.5 mm.; width 2.3 mm.

Two examples collected by Mr. G. R. Pilate at Marlow near Savannah, Georgia, v.-12-1927. In the second example the elytral vittae are indistinct.

The relatively short prothorax with entire lack of sinuation before the nondivergent hind angles gives this species a quite different aspect from those previously described.

Monocrepidius (Heteroderes) planidiscus n. sp.

Form broad and depressed, body throughout deep fuscous, antennae and legs testaceous, lustre dull.

Head scarcely more than half as wide as the prothorax, clypeus arcuate, broadly feebly concave at middle. Antennae scarcely or barely attaining the hind angles of the thorax, joints 2-4 increasing in length, 2 and 3 together slightly longer than 4.

Prothorax as wide as or slightly wider than its length along the median line, sides nearly straight and but little convergent in front except at apex, feebly sinuate before the hind angles, which are but slightly everted; disk distinctly flattened, posterior declivity well marked, hind angles bicarinate, the inner carina much finer and shorter; surface very densely and finely punctulate, with larger punctures quite regularly distributed throughout, these latter separated by from one to two times their own diameter. The pubescence is also dual, the larger punctures bearing very short inclined fuscous hairs, while the interspaces bear still shorter appressed hairs paler in color, these being most noticeable on the posterior declivity.

Elytra not quite as wide and a little more than twice as long as the prothorax, gradually narrowed from about the middle; disk rather flat, striae very

closely punctate; intervals flat, about twice as wide as the striae, sparsely finely punctate, pubescence similar to that of the thorax.

Body beneath densely finely punctate and dull except the prosternum, which is a little more coarsely and less densely punctured, especially anteriorly, and somewhat shining. The lobe of the fourth tarsal joint is of moderate length and slightly wider than the fifth joint.

Length 7.5-10 mm.; width 2.3-2.9 mm.

I have before me a series of thirteen specimens taken at Savannah, Georgia, by G. R. Pilate, and by myself at St. Petersburg, Dunedin and Homestead, Florida. The type is from St. Petersburg and bears date April 9, 1923. This species must be related to the *Heteroderes nicholsi* of Notman, with which it has several features in common. The type of the latter is in the collection of the American Museum of Natural History in New York, and Mr. Mutchler has kindly compared with it a specimen of *planidiscus* sent him for that purpose. He writes that the latter species differs from *nicholsi* by the darker and much less dense pubescence both above and beneath, much deeper elytral striae, more coarsely punctured prosternum before the coxae, and paler tarsi.

Also, judging from descriptions, *planidiscus* must be closely allied to and strongly resemble the Antillean *amplicollis* and the South American *laurenti*. In *amplicollis* the ventral punctures are unequal in size, while in *laurenti* they are subgranulose. In the present species they are fine, dense and perfectly simple.

In the Leng List the *M. sordidus* alone is referred to the genus Heteroderes. *M. robustus* Horn possesses the same type of pronotal punctuation, as was noted by Horn at the time of its description. He did not consider Heteroderes worthy of adoption, and to me it seems to be at most of subgeneric value.

Xarifa lobata n. sp.

Black, scarcely shining; pubescence fine, short, yellowish gray; antennae rufopiceous, legs dark rufous varying to piceous, with paler tarsi.

Head about 4/5 as wide as the prothorax, densely granulose punctate. Antennae not quite half as long as the body, first joint oval, joints 2-8 each suboval and a little elongate, 4, 6 and 8 each slightly shorter than those adjacent to them, 9-11 larger, together as long as the four preceding, 10 slightly shorter than 9 and about ½ longer than wide, 11 twice as long as wide.

Prothorax a little longer than wide, nearly evenly oval, widest just behind the middle, evenly convex, sides not margined, surface closely granulose punctate.

Elytra ⅓ wider and 2½ times as long as the prothorax; parallel or barely perceptibly widening posteriorly; with fine punctured striae, interspaces finely punctate, feebly rugulose.

Body beneath finely punctulate and thinly pubescent; second ventral segment strongly lobed at middle.

Length 2.4-2.6 mm.; width .9-1 mm.

Carmel, Monterey Co. California, v-18-1913. Two examples collected and sent me by Dr. E. C. VanDyke. The type is returned to the collection of the California Academy of Science; the paratype remains in my collection.

Except for the striate elytra and the median lobe-like prominence of the

*—Trans. Am. Ent. Soc. **xxxi**, 1905, p. 13.

2nd ventral suture this little species conforms so closely to my diagnosis of the genus Xarifa* that the erection of a new genus seems unnecessary. The outer three joints of the antennae are shorter than in *X. insularis,* the head is not as wide, the size is a little larger and the color black instead of brown. The sex of the two individuals before me is not apparent.

Methia brevis n. sp.

Piceous black, opaque, attenuate behind. Pubescence sparse and erect on the thorax; shorter, recumbent, and grayish on the elytra, with scarcely a trace of any erect hairs except near the base.

Antennae (♂) brownish fuscous, twice as long as the body, the minute button-like second joint quite evident, basal joint without apical tooth or mucro. Eyes very narrowly separated. Head (or neck) behind the eyes punctate and roughly alutaceous.

Prothorax as long as wide, base and apex equal, sides arcuate medially, scarcely constricted at either base or apex, surface very finely rugulose, not noticeably punctate and without discal callosities.

Elytra much shorter than the abdomen, 2/3 longer than the head and thorax united and about 2¼ times as long as wide; narrowed posteriorly; surface finely scabrous, not densely punctate, disk with two barely perceptible costae which converge from base, uniting and ending at apical third.

Body beneath and legs piceous brown, venter strongly longitudinally impressed, the fifth segment broadly deeply roundly emarginate about as usual in this sex (♂).

Length to tip of elytra 6.5 mm.

Described from a single male example from San Diego County, California. The color if constant will distinguish this species from all previously described.

Blapstinus cinerascens n. sp.

Form rather stout oblong oval, moderately convex; black, conspicuously clothed with recumbent ashy white pubescence.

Antennal length slightly greater than that of the prothorax, the 3rd joint equal in length to the next two. Eyes separated by nearly six times their own width (♀) or a little less (♂).

Prothorax subequal in width to the elytra at base, ⅓ wider than long, sides evenly rather strongly arcuate and feebly convergent towards the front, widest at or slightly behind the middle, angles all a little obtuse and sharply defined. Head and prothorax densely evenly punctate.

Elytra subparallel in basal half, 2¾ times as long as the thorax, feebly striate, the striae with coarse rounded approximate perforate punctures.

Abdomen moderately punctate and pubescent; front tarsi very little wider in the male than in the female.

Length 5.4-6 mm.; width 2.2-2.4 mm.

Southern California. The series before me is from San Pedro and Long Beach. The type is a female from the first named locality.

This is the species which Casey in his review of the genus (Coleopt. Notices II, 1890) interpreted as the *pubescens* of LeConte. The true *pubescens* is quite different; it has a less transverse and differently shaped thorax, the sides

being much less rounded, and parallel in more than basal half, the pubescence yellowish rather than cinereous. It was described from the desert region of southeastern California.

Conotrachelus retusus n. sp.

Robust, piceous, the antennae, legs and sometimes the elytra brown or reddish brown; pubescence mottled ochreous and white, and consisting of short appressed slender scales or scale like hairs without trace of erect bristles. Beak rather stout, as long as the prothorax, strongly striate and carinate, a small perforate fovea between the eyes. Antennae inserted at ⅓ or a little less from the apex, first four funicular joints decreasing in length, the 2nd nearly twice as long as wide, the 4th slightly longer than wide.

Prothorax 5/6 as long as wide, sides strongly rounded at apical fourth, thence nearly straight and parallel to base; apical constriction not strong; surface densely rather coarsely cribrate punctate with a fine incomplete median carina which may become entirely obsolete; pubescence consisting of sparse obscure recurved and recumbent longer hairs, with a small loose group of shorter whitish squamiform hairs at base within the angles.

Elytra 4/5 wider than the prothorax and ⅓ longer than wide, sides nearly parallel in basal half, humeri rounded; alternate interspaces finely nearly evenly carinate, serial punctures moderately coarse basally, becoming finer apically; pubescence ochreous and white, not very conspicuously mottled, condensed in a transverse spot or fascia at the summit of the declivity in which the white scales are chiefly aggregated on the carinate, and the yellow scales on the noncarinate intervals; there is a conspicuous elongate spot of white scales at the base of the third interspace.

Beneath, mesosternum vertical in front but not projecting or emarginate. Ventral segments rather closely evenly punctate, the first two quite coarsely, 3-5 progressively more finely so; thighs with a long tooth which is blunt at apex.

Length 5-5.5 mm.; width 2.6-2.8 mm.

Described from three examples bearing label Florida, but without indication of precise locality.

No sexual differences are obvious; in all the last ventral is nearly flat with a feeble apical impression.

This species belongs to LeConte's Group "I-B" and would by his table fall between *posticatus* and *geminatus*. It resembles *cognatus* very closely in the mottling of the elytra, but that species is smaller and less robust, the thorax less coarsely cribrate and the mesosternum is prominent and bifurcate in front.

SYNONYMIC NOTES ON CANADIAN EUPITHECIAS (GEOMET., LEPID.)*

BY J. MCDUNNOUGH,
Ottawa, Ont.

The excellent results obtained by a study of both male and female genital organs when determining specimens of this difficult genus in connection with my paper on the "Lepidoptera of Seton Lake, B. C." have led me to continue this

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

work with a view to clearing up the numerous synonymical tangles in our Canadian species. The variability within the limits of a single species, the poor condition of much of the type material, and the failure of authors such as Taylor, Pearsall and Swett not only to recognize each other's species, but to realize the wide-spread distribution of the individual species, have all contributed to produce a muddle of specific names which has been almost impossible to unravel by a mere study of external characters. Fortunately in the genitalia, as has been excellently demonstrated by Petersen for the Palearctic members of the genus (1909, Iris, xxii, 203-313), we have a sure specific basis and a careful examination of these organs in the actual type specimens should eventually result in bringing order into the present chaotic condition of our North American species.

Through the kindness of Dr. Wm. Barnes of Decatur, Ill. I have been permitted to make slides of the genitalia of a number of Taylor's types, now contained in the Barnes collection; also through the co-operation of the late Dr. H. G. Dyar I have had a similar opportunity of studying the genitalia of the types of the species described by him from Kaslo, B. C. and deposited in the United States National Museum. A good deal of further work will be required in the matter of Hulst's and Pearsall's types; some of this I already have in hand but as this study may be delayed for some time owing to press of other duties I have considered it advisable to incorporate in the present paper the main synonymic results of my examinations as far as they have been carried out. I have made little attempt to treat of racial varieties, my main endeavor being to bring the numerous proposed names into a correct relationship, a feature which was far from being accomplished in our 1917 Check List.

Eupithecia silenata Stndfs.

Eupithecia silenata Standfuss, 1849, Bresl. Ent. Zeit., 15; Petersen, 1909, Iris xxii, 252, Pl. xiii, fig. 59.
Tephroclystis misturata Hulst, 1896, Trans. Am. Ent. Soc., xxiii, 266, Barnes and McDunnough, 1916, Contrib. iii, 177; McDunnough, 1927, Can. Ent., lix, 243.
Tephroclystis subfoveata Dyar, 1904, Proc. U. S. N. M., xxvii, 892.
Eupithecia insignificata Taylor, 1906, Can. Ent., xxxviii, 394.
Eupithecia sublineata Taylor, 1906, Can. Ent., xxxviii, 395.
Eupithecia minorata Taylor, 1907, Trans. Roy. Soc. Can., i, 202.
Eupithecia scelestata Taylor, 1907, Trans. Roy. Soc. Can., i, 202.
Eupithecia frostiata Swett, 1907, Can. Ent., xxxix, 377; Barnes and McDunnough, 1912, Can. Ent., xliv, 275.
Eupithecia conformata Pearsall, 1908, Ent. News, xix, 128.

Specimens examined. Misturata Hlst., topotypical male (the type in the Rutgers College Coll., New Brunswick, N. J. is without abdomen); *subfoveata* Dyar, type male, ex U. S. N. M.; *insignificata* Tayl., type male, ex Coll. Barnes; *sublineata* Tayl., type female, ex Coll. Barnes; *minorata* Tayl., type male, ex Coll. Barnes; *scelestata* Tayl., paratype male, in the Canadian National Coll., ex Coll. Cockle; *frostiata* Swett, female, marked as agreeing with type in Coll. Barnes; *conformata* Pears., paratype male, in the Canadian National Collection. Besides these numerous specimens of both sexes from various British Columbia and California localities and from Ottawa, Ont.

I can find nothing in the genitalia of our North American specimens which would warrant a separation from the European species as figured by Petersen. It will be interesting to see if the larvae are also found in this country on *Silene;* Dr. Dyar, who bred a few specimens from the egg, fed the caterpillars on *Ceanothus* but this can hardly be regarded as the true food plant.

If so desired eastern specimens may retain the name *frostiata* in a varietal sense but there is really no tangible difference of maculation. In the genitalia I could observe a slight difference in the female organ, the ductus bursae in the single eastern specimen examined showing a greater length of heavier chitinization than was found in western specimens; with more material even this might not prove constant.

Eupithecia harveyata Tayl.

Eupithecia harveyata Taylor, 1906, Can. Ent., xxxviii, 390.

Specimens examined. Holotype, male, allotype, female, ex Coll. Barnes; paratype male, ex Coll. Blackmore; two males, Victoria, B. C.

There is no difference between the genitalia of *harveyata* and those of the preceding species, *silenata*, but I hesitate to add the name at present to the long list of synonyms of *silenata* on account of the much larger size of the specimens before me and the generally paler ground color with consequently better-defined cross-lines. A knowledge of the life history will be necessary to solve the problem.

Eupithecia pygmaeata Hbn.

Eupithecia pygmaeata Hubner, 1800, Samml. Eur. Schmett. Geom., f. 234, Petersen, 1909, Iris, xxii, 267, Pl. xx, f. 83.

Eupithecia obumbrata Taylor, 1906, Can. Ent., xxxviii, 393.

Specimens examined. *Obumbrata* Tayl. type female, ex Coll. Barnes; also other specimens of both sexes from Labrador, Waterton, Alta., and Victoria, B. C.

The female bursa copulatrix is very striking as a reference to Petersen's figure will show; I can find nothing in the genitalia of either sex to warrant the separation of North American specimens as distinct specifically from the European *pygmaeata*.

Eupithecia bryanti Tayl.

Eupithecia bryanti Taylor, 1906, Can. Ent., xxxviii, 392.

Eupithecia modesta Taylor, 1906, Can. Ent., xxxviii, 393.

Specimens examined. *Bryanti* Tayl., type female, ex Coll. Barnes and paratype female, in Canadian National Collection; *modesta* Tayl., type male, ex Coll. Barnes. Also one male, Waterton, Alta.; one female, Victoria, B. C.

I feel reasonably sure of the above association although my female material of *modesta* is very limited and I should have preferred to have made more slides of the bursa which is not always easy to secure in an inflated condition.

Eupithecia castigata Hbn.

Geometra castigata Hubner, 1818, Samml. Eur. Schmett. Geom. f. 456; Petersen, 1909, Iris, xxii, 246, Pl. x, f. 46B, Pl. ix, f. 42A (as *virgaureata* in err.); Pierce, 1914, Gen. Brit. Geom., 50, 52, Pl. xxxi.

Eupithecia latipennis Hulst, 1898, Can. Ent., xxx, 114.

Specimens examined. Numerous specimens of both sexes from Ontario, Alberta and British Columbia.

While there has been no opportunity as yet of examining the genitalia of Hulst's type, I feel certain from former comparisons that the identity of *latipennis* has been correctly established. The genitalia are in every respect similar to those of the European *castigata*.

Eupithecia albipunctata Haw.

Geometra albipunctata Haworth, 1810, Lep. Brit. 360; Petersen, 1909, Iris, xxii, 244, Pl. ix, f. 40; Taylor, 1909,, Can. Ent., xli, 428.

The recording of this species by Dr. Taylor from North America is correct.

I have discovered in our material four females from Calgary and Waterton Lakes, Alta., and Kaslo and Ucluelet, B. C. which can at once be identiefid as *albipunctata* by the very striking bursa copulatrix.

Eupithecia fletcherata Tayl.

Eupithecia fletcherata Taylor, 1907, Ottawa Nat., xx, 200; Can. Ent., xxxix, 384.

Specimens examined. Type male, ex Coll. Barnes (the type female in the Canadian National Collection is without abdomen). Also males from Kaslo, B. C., Meach Lake, Que. and Strathroy, Ont., and one female from Trenton, Ont.

Judging by the male genitalia I should incline to place *fletcherata* as a North American race of the European *virgaureata* Dbldy., the genitalia of which are figured by both Petersen and Pierce, the former, as pointed out by Pierce, having in error transposed his male figures of *castigata* and *virgaureata*. The single slide I have been able to make of the female genitalia is not so conclusive, due to shrivelling, and as Pierce's and Petersen's figures of the bursa copulatrix do not coincide I prefer to leave the matter for the present in abeyance. It might be pointed out that Dietz's figures (758, 759) of the Lapland form of *virgaureata*, as also those of the summer form (756, 757) run very close to our *fletcherata*.

Eupithecia luteata Pack.

Eupithecia luteata Packard, 1867, Proc. Bost. Soc. Nat. Hist., xi, 46.
Tephroclystis bifasciata Dyar, 1904, Proc. U. S. N. M., xxvii, 891.
Eupithecia catskillata Pearsall, 1908, Ent. News, xix, 192.
Eupithecia fasciata Taylor, 1910, Can. Ent., xlii, 79; Barnes and McDunnough, 1918, Contrib. iv, (2), 145.

Specimens examined. Luteata Pack., type male, ex Camb. Mus. Comp. Zool. through the kindness of Dr. N. Banks and Mr. S. Cassino; *bifasciata* Dyar, topotype female, (the type female in the Canadian National Collection, ex Coll. Cockle, has lost its abdomen); *catskillata* Pears., paratypes male and female; also other specimens from Ontario, Quebec and British Columbia.

The short blunt projection from the edge of the male clasper near the base is quite characteristic of the species. I can see no differences between the form of the bursa copulatrix in eastern and western specimens but the name *bifasciata* can be retained, if desired, for the slightly larger British Columbian race. The genitalia are very close to those of the European *lariciata* but I hesitate to make this reference definitely at the present time as Petersen's and Pierce's figures of these organs do not quite agree and Dietz's figure of the adult is not very close.

Eupithecia columbiata Dyar.

Tephroclystis columbiata Dyar, 1904, Proc. U.S.N.M., xxvii, 891.
Eupithecia erpata Pearsall, 1908, Ent. News, xix, 193.

Specimens examined. Columbiata Dyar, type male in Canadian National Collection, ex Coll. Cockle; *erpata* Pears, paratypes male and female, in Canadian National Collection. Other specimens from Ontario, Quebec and British Columbia.

Specimens from the east show no differences of genitalia from British Columbian ones and I can see no particular reason for retaining both names.

Eupithecia harlequinaria Dyar.

Tephroclystia harlequinaria Dyar, 1905, Proc. Ent. Soc. Wash., vii, 29.
Eupithecia dyarata Taylor, 1906, Can. Ent., xxxviii, 101, 390; Barnes and McDunnough, 1912, Can. Ent., xliv, 271.

Specimens examined. Harlequinaria Dyar, type female, ex U. S. N. M.; *dyarata* Tayl., topotype female, (the type female has lost its abdomen); other male and female specimens from Victoria, Kaslo, Seton Lake and Oliver, B. C.

Harlequinaria was described from two specimens from Victoria, B. C., a cotype being deposited in each of the two institutions, the U. S. National Museum and the B. C. Provincial Museum. As these cotypes are apparently not conspecific I choose as holotype the female specimen in the U. S. National Museum, type No. 8176. The typical form from southern Vancouver Island and the Lower Fraser Valley is rather brightly colored and shows a certain amount of ochreous shading; *dyarata* from the Southern Interior of British Columbia is duller in color and rather evenly dark gray without the ochreous tints. The genitalia are similar and the species evidently belongs close to *columbiata* according to the form of the claspers and the plate of the eighth sternite.

Eupithecia edna Hulst.

Tephroclystis edna Hulst, 1896, Trans. Am. Ent. Soc., xxiii, 266.
Tephroclystis ornata Hulst, 1896, Trans. Am. Ent. Soc., xxiii, 267.

As far as I can judge these two names are based on the two sexes of a single species, *edna* on the male and *ornata* on the female. The former name has page priority.

Eupithecia coagulata Gn.

Our North American species going under this name comes uncomfortably close to the European *assimilata* Gn. both in maculation and structure of the genital organs. In like manner *geminata* Pack. is very evidently the North American representative of *absinthiata* Clerck. I am not making these references definite at the present time as I wish to first study the genitalia of European specimens.

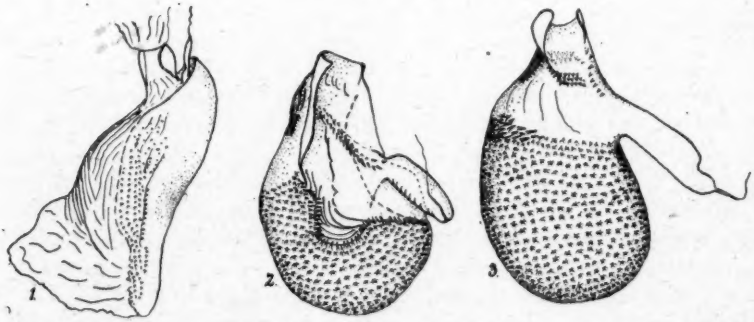

Fig. 1. Bursa copulatrix of *Eupithecia kasloata* Dyar. Fig. 2. Bursa copulatrix of *Eupithecia ammonata* n. sp. Fig. 3. Bursa copulatriv of *Eupithecia coagulata* Gn.

I find, however, that we have a third species belonging to this group which appears to be without a name; I describe it as follows:—

Eupithecia ammonata n. sp.

Very similar to *coagulata* Gn. and best distinguished by the narrower discal dash on primaries and the entire lack of the discal dot on secondaries. The cross lines of primaries are faint, the only one that is well-evident being the median line; this line, bending at about right angles below costa, passes directly through the discal dash. In the male genitalia the aedoeagus is armed with only three pieces of chitin as compared with four in *coagulata;* the female bursa copulatrix shows considerable difference to that of *coagulata,* as a reference to the figure will show.

Holotype.—♂, Red Deer River, 50 Miles N. E. of Gleichen, Alta., July 5 (Dod); No. 2970 in the Canadian National Collection.

Allotype.—♀, Calgary, Alta., July 1 (Dod).

Paratypes.—1 ♂, Calgary, Alta., June 30 (Dod); 1 ♂, Red Deer River, Alta., July 5 (Dod); 1 ♂, Indian Head, Sask., July 19 (de Gryse); 1 ♀, Red Deer River, Alta., July 6 (Dod); 1 ♀, Aweme, Man., July 12 (N. Criddle).

Eupithecia satyrata Hbn.

Geometra satyrata Hubner, 1818, Samml. Eur. Schmett. Geom. f. 439; Petersen, 1909, Iris, xxii, 251, Pl. xiii, f. 57.
Eupithecia dodata Taylor, 1906, Can. Ent., xxxviii, 103.
Eupithecia fumata Taylor, 1910, Can. Ent., xlii, 82.
Eupithecia mackicata Cassino and Swett, 1924, Lepid. iv, 45.

Specimens examined. Dodata Tayl., type female, ex Coll. Barnes; *fumata* Tayl., type female, ex Coll. Barnes; *mackicata* C. & S., paratypes male and female, in the Canadian National Collection. Also numerous male and female specimens from Alberta, Ontario, Quebec and Labrador.

The species is variable but there is nothing in the genitalia to distinguish eastern and western specimens either from each other or from the European *satyrata* as figured by Petersen.

It is possible that *younaata* Tayl. will also fall here but all that remains of the type are three wings pasted on cardboard and I couldn't quite match these. The paratypes from the Catskill Mountains, N.Y. fall into another group, but I am not certain that they are conspecific with the type.

Eupithecia terminata Tayl.

Eupithecia terminata Taylor, 1908, Can. Ent., xl, 58.
Eupithecia slocanata Taylor, 1908, Can. Ent., xl, 59.

Specimens examined. Terminata Tayl., type male, ex Coll. Barnes and paratype male, in the Canadian National Collection; *slocanata* Tayl., type male, ex Coll. Barnes and allotype female, in same collection. Other specimens of both sexes from Alberta and British Columbia.

The three specimens which served for the original description of *terminata* are all labelled "cotype:" to avoid any trouble I herewith designate the male cotype in Coll. Barnes as the holotype. I would further designate the male cotype of *slocanata* in this same collection as the holotype of this latter species; the cotype in the Canadian National Collection ex Coll. Cockle to which I have already had occasion to refer (1927, Can. Ent. lix, 243) is not conspecific with the two in the Barnes collection.

The species is only doubtfully distinct from *satyrata* and I should be much inclined to place it as a large western race of this species: *slocanata* is based on a rather suffused form with indistinct maculation.

Eupithecia helveticaria Bdv.

Eupithecia helveticaria Boisduval, 1840, Ind. Meth. 208; Petersen, 1909, Iris xxii, 250, Pl. xii, f. 55.
Eupithecia gibsonata Taylor, 1910, Can. Ent., xlii, 78.
Eupithecia chagnoni Swett, 1911, Can. Ent., xliii, 255.

Specimens examined. Gibsonata Tayl., type male, ex Coll. Barnes; *chagnoni* Swett, metatype from Sebec Lake, Me. in Canadian National Collection; other specimens from Ottawa, Ont.

The adults can be beaten from Juniper bushes in early spring in the Ottawa region and I have found the larvae quite plentiful in late fall on the same plant.

There is considerable variation in the distinctness of the maculation, the type of *gibsonata* being a very strongly marked specimen.

Eupithecia indistincta Tayl.

Eupithecia indistincta Taylor, 1910, Can. Ent., xlii, 82; Barnes and McDunnough, 1912, Can. Ent., xliv, 273.

Specimens examined. Type female, ex Coll. Barnes.

The bursa copulatrix of the type female matches so closely Petersen's figure and description of this organ in the European *veratraria* H. S. that I feel greatly tempted to list *indistincta* as a synonym. Before definitely doing this, however, it would be well to have more material of both sexes available for examination.

The specimen from Toronto, Ont., mentioned by Taylor in the original description of *indistincta*, proves on examination of the genitalia to be merely a worn female of *geminata* Pack.; as far as I know the true *indistincta* has not yet been taken in Canada.

Eupithecia nimbicolor Hlst.

Tephroclystia nimbicolor Hulst, 1896, Trans. Am. Ent. Soc., xxiii, 269.
Tephroclystia obscurior Hulst, 1896, Trans. Am. Ent. Soc., xxiii, 271; Barnes and McDunnough, 1918, Contrib. iv, 146.
Eupithecia adornata Taylor, 1906, Can. Ent., xxxviii, 104.

Specimens examined. Nimbicolor Hlst., type male, ex Coll. Rutgers College; *obscurior* Hlst., type male, ex Coll. Rutgers College; *adornata* Tayl., type male, ex Coll. Barnes. Other specimens of both sexes from Alberta and British Columbia.

A study of the genitalia of the types confirms my reference of *adornata* to *obscurior*. I believe that both names will fall to *nimbicolor*, described from a single male from Calgary, Alta., but it might be well to point out that in the slide of the genitalia made from the type specimen the armature of the aedoeagus consists of three irregularly shaped pieces of chitin whilst in *obscurior* there are four such pieces; the eighth sternal plate and the remainder of the genital organs seem, however, to be similar in both cases and I am inclined to think that the difference is individual rather than specific, especially as my other slides of Calgary males show a certain amount of variation among themselves. *Incresata* Pears. may also fall here but as yet I have had no chance to study the type.

Eupithecia kasloata Dyar.

Tephroclystis casloata Dyar, 1904, Proc. U. S. N. M., xxvii, 891.

Specimens examined. Type female, ex Coll. U. S. N. M., one other female from Kaslo, B. C.

This species was described from two specimens, the type female being deposited in the U. S. National Museum and the paratype retained by Mr. Cockle and later acquired by the Canadian National Collection.

The usual idea of this species, based on the Cockle paratype is incorrect; this paratype consists merely of three wings pasted on cardboard but there is no doubt that it represents a large form of the eastern *geminata* Pack. which is apparently quite common in the Kaslo region and of which a long series is before me. The true *kasloata*, as represented by the type in the U. S. National Museum, is something altogether different, the bursa copulatrix being quite distinct; I have been able to match it with a single Kaslo female, captured August 25, 1913, but unfortunately both specimens are too worn to allow of any accurate description

of the maculation, so for the present I must content myself with offering a figure of the bursa.

Eupithecia gelidata Moesch.

Eupithecia gelidata Moeschler, 1860, Wien. Ent. Monats. iv, 376; 1883, Stett. Ent. Zeit. 122; Dietz, 1910, Biol. der Eupith. Pl. 75, f. 481.
Euyithecia hyperboreata Staudinger, 1861, Stett. Ent. Zeit. 400; Petersen, 1909, Iris, xxii, 270, Pl. xxii, f. 90.
Tephroclystis flebilis Hulst, 1900, Proc. Wash. Acad. Sci., ii, 497; Barnes and McDunnough, 1918, Contrib. iv, 145.
Eupithecia lagganata Taylor, 1910, Can. Ent., xlii, 57.
Eupithecia compactata Taylor, 1910, Can. Ent., xlii, 58.
Eupithecia nordeggensis Cassino and Swett, 1922, Lepid. iii, 164.

Specimens examined. *Flebilis* Hlst., type male, ex U. S. National Museum; *lagganata* Tayl. type male, ex Coll. Barnes; *compactata* Tayl., type female, ex Coll. Barnes; *nordeggensis* C. & S., paratype female, in Canadian National Collection, received from K. Bowman, Edmonton, Alta. Also 1 male, Greenland, in Canadian National Collection; 1 male, Nordegg, Alta. ex Coll. K. Bowman; 1 male, Ucluelet, B. C.

Gelidata was described from a single female from Labrador of which I know nothing; later (1883) Moeschler referred some Greenland specimens to this name and one of them is figured by Dietz as a so-called cotype, the name being doubtfully placed as a variety of *nanata*. The Greenland male from which I have made a slide and which, as far as can be told, agrees closely with Dietz's photograph disproves this association as the structure of both clasper and penis are closer to Petersen's figure of *hyperboreata* than to that of *nanata*. The other slides of male genitalia before me are all very uniform; the slides of the female genitalia are not so satisfactory as in both cases the bursa copulatrix was somewhat shrivelled and an exact comparison was difficult; however, when more material is available I believe my synonymy will be confirmed.

Eupithecia innotata Hufn.

Geometra innotata Hufnagel, 1769, Berl. Mag. iv, 616; Petersen, 1909, Iris, xxii, 271, Pl. xxii, f. 91.
Tephroclystis cootenaiata Dyar, 1904, Proc. U. S. N. M., xxvii, 890.
Eupithecia alberta Taylor, 1906, Can. Ent., xxxviii, 103.
Eupithecia youngata Taylor, 1906, Ottawa Nat., xix, 226 (*partim*, Cotypes).
Eupithecia slocanata Taylor, 1908, Can. Ent., xl, 59 (*partim*, female, Cotype).
Eupithecia winnata Taylor, 1910, Can. Ent., xlii, 77.

Specimens examined. *Cootenaiata* Dyar, type male; *alberta* Tayl., type male, ex Coll. Barnes; *youngata* Tayl., Cotype male, ex Coll. Barnes; *winnata* Tayl., type female, ex Coll. Barnes; numerous specimens of both sexes from Alberta and British Columbia; 1 male, Trenton, Ont., 1 female, Ottawa, Ont., this latter labelled by Taylor, *youngata*.

I consider that at the best our North American forms can only be treated as local races of the very variable European species *innotata;* there is no appreciable difference in the female genitalia and in the males the armature of the penis is extremely similar to Petersen's figure and not altogether constant, as shown by my numerous slides. Our material from the east is very scanty and not in the best of condition so it is hard to say whether *winnata* may be separated off as a good race or not. I already have commented on the type of *youngata* under *satyrata*.

Eupithecia hanhami Tayl.

Eupithecia hanhami Taylor, 1906. Can. Ent., xxxviii, 390.

Specimens examined. Allotype female, ex Coll. Barnes (the male type is without abdomen). Also one male and one female from Ucluelet and Victoria, B. C., respectively.

In both sexes of *hanhami* the genitalia appear to be identical with those of *innotata*. In all probability, therefore, we must consider it as a local race of this variable species, distinguished by its paler ground color and better defined maculation; until, however, we know something of its early stages I hesitate to make this reference definite.

Eupithecia perfusca Hlst.

Tephroclystis perfusca Hulst, 1898, Can. Ent., xxx, 116; Taylor, 1908, Can. Ent., xl, 58; Barnes and McDunnough, 1918, Contrib. iv, 145.
Eupithecia spaldingi Taylor, 1910, Can. Ent., xlii, 58.

Specimens examined. *Spaldingi* Tayl., type male, ex Coll. Barnes. Other specimens of both sexes from Utah.

The holotype of *perfusca* was designated by Taylor as the female in the Collection of the United States National Museum. This type was examined by me in 1917 and commented on in our Contributions. Unfortunately since then it has apparently been misplaced or lost, as Dr. Dyar was unable to locate it at my request. I have seen a female specimen which Mr. S. Cassino of Salem, Mass. had compared with this type and which fully bears out my remarks on the species; according to the genitalia of this specimen the species falls in the *innotata* group with *spaldingi* obviously the male sex. I should not be at all surprised if it proved to be nothing but a pale semi-desert race of *innotata;* there is nothing very tangible in the genitalia by which to separate it.

With the above synonymy established the species determined as *perfusca* by Rev. Geo. W. Taylor and others is now without a name. I propose the following one:—

Eupithecia georgii n. sp.

Eupithecia perfusca Taylor (*nec* Hulst) 1908, Can. Ent., xl, 58.

Very similar in size, color and maculation to *terminata* Tayl. as pointed out by Taylor. Forewings slightly more rounded apically and with a distinct brown

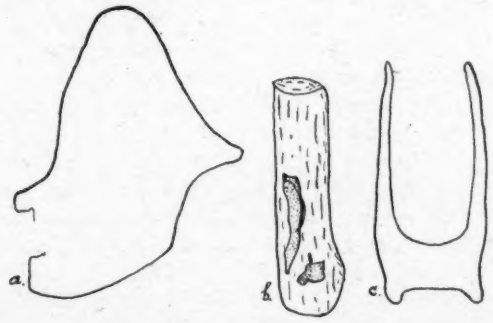

Fig. 4. *Eupithecia georgii* n. sp. (*a*) Male clasper; (*b*) aedoeagus; (*c*) eighth ventral plate.

shade on the cubital vein at the junction of veins three and four, the bases of which are also tinged with the same color. The hind wings are more maculate

than in *terminata,* especially on the inner half of the wing where dark and light dots alternate to form a distinct pattern; the submarginal pale waved line is also distinct. The male genitalia are totally different from those of *terminata* as a reference to the figure will show and appear to approach closest to those of the European *insigniata* Hbn. as figured by Pierce (Gen. Brit. Geom. Pl. xxvii.).

Holotype.— ♂, Kaslo, B. C., June 14 (J. Cockle), No. 2969 in the Canadian National Collection.

Allotype.— ♀, same locality, June 8.

Paratypes.—7 ♂, 7 ♀, same locality, various dates from May 16-June 21. There are also specimens before me from Waterton Lake, Alta., Victoria, B. C. and Wallace, Idaho.

Eupithecia sobrinata Hbn.

Geometra sobrinata Hubner, 1818, Samml. Eur. Schmett. Geom. f. 465; Petersen, 1909, Iris, xxii, 277, Pl. xxv, f. 101.
Eupithecia interruptofosciata Packard, 1873, Fifth Rep. Peab. Acad. Sci. 59; 1876, Mon. Geom. U. S., 52.
Tephroclystis niphadophilata Dyar, 1904, Proc. U. S. N. M., xxvii, 890.
Eupithecia quebecata Taylor, 1910, Can. Ent., xlii, 81.

Specimens examined. Niphadophilata Dyar, paratype female in the Canadian National Collection; *quebecata* Tavl., type female, ex Coll. Barnes; other specimens of both sexes from Alberta, Ontario and Massachusetts.

The larva of this species is very common on juniper in the Ottawa region in early spring, the moth emerging in September; in all its stages our species agrees with Dietz's account of the life history of the European *sobrinata.*

Niphadophilata can only be treated as a rather paler and larger western race as the genitalia are quite similar to those of eastern specimens.

Eupithecia annulata Hlst.

Tephroclystia annulata Hulst, 1896, Trans. Am. Ent. Soc., xxiii, 267; Barnes and McDunnough, 1918, Contrib. iv, 145.
Eupithecia limnata Pearsall, 1909, Proc. Ent. Soc. Wash., xi, 126.

The type of *annulata* is without abdomen but I believe my former reference of *limnata* Pears. as a synonym to be correct.

This species, together with *usurpata* Pears., *filmata* Pears. and *olivacea* Tayl., forms a compact group characterized by the lengthily ciliate antennae in the male sex and the very early appearance in the spring of the adults. The genitalia are all very similar but may be separated in the case of *annulata, filmata* and *olivacea* by the depth of the apical bifurcation of the eighth ventral plate in the male and by the greater or less spining on the dorsal surface of the bursa copulatrix in the female. I have examined the genitalia of cotype males of both *usurpata* and *limnata* from the United States National Museum and also those of a male and female *usurpata* in the Canadian National Collection (evidently taken along with the type lot as they are dated Victoria, B. C., 5.iv.03, E. M. Anderson) and can find no difference in these organs between the two species. However the point stressed by Pearsall that the antennae of the male *usurpata* are much less strongly ciliate than those of *annulata (limnata)* is certainly borne out by the specimen before me which although not in the best of condition also agrees with Pearsall's characterization in the smaller discal dot and more generally suffused appearance. Until more and better material is available for study it would seem better to list the two as good species.

I have three eastern females from Ottawa, Ont., Montreal, Que. and Nor-

wood, Mass. which I take to be *filmata* Pears. although I have not had an opportunity of recent years of studying the types; these agree in genitalia with a series of Edmonton, Alta. females; similar specimens have been commonly distributed (I think on the authority of Mr. Swett) as *limnata*, and are so listed in Bowman's Check List, but I believe this is an error; *annulata* (*limnata*) does, however, occur in Alberta as there are two females from the Calgary region in our collection ex Coll. Wolley-Dod.

The much deeper-colored *olivacea* Tayl. is apparently a coast species: we have a series from Vancouver Island and also two specimens from Oakland, Calif. I have, further, examined the genitalia of the type female ex Coll. Barnes.

CONCERNING *CICADELLA HIEROGLYPHICA* VAR. *DOLOBRATA* BALL (HOMOPTERA, CICADELLIDAE).

BY PAUL B. LAWSON,
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This variety of *C. hieroglyphica* was described by Ball (1) as follows:

"Somewhat smaller than the preceding. Shining black, a few of the white markings of the typical form persisting, as follows: the margins of the clypeus, the genae, a line below the margin of the pronotum, the circle around the apex of head, a line against the eye, and the marking of the scutellum. Often there is part of a median line on vertex and a pair of slender lines running from the inner corner of the eye back across the pronotum to the light margined claval suture"

Olsen (2) in discussing this variety states: "I have never seen a female that would answer entirely to the colour description of this variety." In speaking of the examination of a certain lot of specimens from Langdon, Missouri, he says: "Seventeen specimens, nine males (typical *dolobrata*), eight females, rather slate gray in general appearance, with a good deal of light pattern in strong contrast to the markings on the vertex and anterior part of the pronotum. They would very well pass for Ball's 'slaty form' but are undoubtedly the females of the above mentioned males." Speaking of another lot from central Missouri, he says: "Ten specimens pasted on a card, seven of which are typical *dolobrata* males, the remaining three were females with the vertex and pronotum as in the former lot, but a shade darker on the elytra. These are almost indisputably males and females of the same brood." From this, Olsen concludes that "the 'slaty form' mentioned by Dr. Ball, 1901, should, without doubt, be referred to the variety *dolobrata* rather than to *hieroglyphica*."

Hackman (3) in a paper on the life history of *C. hieroglyphica* (Say) writes as follows:

"The second generation, or the overwintering one, consists of the typical reddish adults. The sexes can be easily distinguished one from the other by the darker color of the male abdomen as contrasted with the lighter color of the female's. These produce the slaty-gray individuals of the summer generation. The black form, the variety *dolobrata*, is also present at this season. However, only males of this form have been found. They mate with the slaty-gray individuals, which are for the most part females, although males of this

type are numerous. Very evidently, the dark forms are dimorphic males of the summer generation."

Numerous observations both in the field and on collections made by the writer confirm the above except perhaps for the common occurrence of "slaty gray" males. Every specimen labelled *dolobrata* in all collections examined has been a male and the writer has seen but few "slaty gray" males.

As an example of many field observations, on June 30, 1928 at Lawrence, Kansas, the writer collected from the untold thousands of the summer generation on *Salix longifolia*, 875 specimens. As this was the generation produced by the overwintering "red form," which must be considered the typical form of the species, none of the latter were present and all the specimens were, therefore, dark. Of these specimens, 650 were males and all were of the typical *dolobrata* form except for some half-dozen slaty-gray specimens. The summer brood has, therefore, the typical "*dolobrata*" males which are by far the most common form, and a dimorphic "slaty gray" male in much lesser numbers. The 225 females were all of the "slaty gray" form and no other forms of females were present anywhere in the field at this time.

The writer, therefore, agrees with Olsen that the name *dolobrata* should be applied to the "slaty gray" form as well as to the darker males, thus making this name apply to both sexes, including both types of males, of the summer generation of this species, while *C. hieroglyphica* var. *hieroglyphica* (Say) applies to both sexes, which are red, of the overwintering generation.

Whether different varietal names should be given to different broods of the same species of insect is a practice which is quite doubtful both biologically and taxonomically, yet in this case, because of the extreme difference in the color of the two broods, it is certainly convenient for the systematist to have a suitable "handle" for the designation of such varicolored insects, and from the standpoint of a practical working basis, the two names should be retained.

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A SWARM OF MALES OF THE RARE AND PRIMITIVE CRANEFLY PROTOPLASA FITCHII OBSERVED NEAR CHANDLER IN THE GASPE PENINSULA (DIPTERA).

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While making an "auto" trip around the Gaspé Peninsula (Province of Quebec) in the summer of 1928, I encountered a swarm of dark-winged insects which I at first took to be may flies "dancing" over a bridge across a river to the west of Chandler—a town on the south shore, well out toward the eastern end of the Gaspé Peninsula. Stopping the car, I descended to make a few "investigational" sweepings with my net, and to my utter amazement discovered that I had captured a net full of males of the rare and much-sought (because of its primitiveness) "cranefly" *Protoplasa fitchii*, O.S., a member of the superfamily Psychodoidea.

One male Protoplasa from North Carolina (near Ashville) and four females from Sacandaga Park, N.Y. (where Dr. C. P. Alexander had succeeded in collecting about a dozen specimens of Protoplasa, after making numerous trips especially for the purpose) were the hard earned prizes resulting from my previous efforts to collect specimens of Protoplasa for anatomical study; and since there are probably much less than a dozen specimens of Protoplasa, all told, in the other collections of the entire world, one can imagine the thrill that I experienced in capturing one hundred and eighty one of these *"rarae aves"* in less than twenty minutes of leisurely sweeping (many more than were captured were left unmolested, so that the insect might not be exterminated in this locality)!

My astounding good fortune seemed too good to be true, and at first I feared that I might have been deceived by some cranefly such as Epiphragma, which is superficially very like Protoplasa, and occurs in swarms, but a later examination showed that I had indeed captured an ample supply of Protoplasa material, and Dr. C. P. Alexander, the leading authority on the group, has positively identified my specimens as *Protoplasa fitchii*, O.S. (albeit they are a little darker appearing than specimens from the United States)—and strange as it may seem, this rare and highly prized Dipteron does actually occur in swarms at the right time and place! At the suggestion of Dr. Alexander, I have noted what I can recall of this previously unrecorded and most unexpected swarming of Protoplasa.

The "season" was "late" in the Peninsula, and lilacs and bunch berries (Cornus canadensis) were in bloom, while sawflies were still abundant—conditions suggestive of early summer in New England. The day, June 28th., 1928, had been rather warm and clear, and there was but little breeze blowing when I encountered the swarms of Protoplasa at about eight o'clock (standard time) a short time before sunset.

The bridge over which Protoplasa was swarming, was an iron one, with wooden flooring, but I did not notice any rotten planks in which the insect could oviposit in the floor of the bridge. The river across which the bridge extended was the one I crossed coming into Chandler from the west, and is probably the Rivière Pabos, although I am not sure of this. It is a rather shallow stream about sixty feet wide; and above the bridge, the river flows rather swiftly over a rocky bottom, flowing more quietly in the deeper waters below the bridge. The trees and bushes along the banks of the river did not grow very densely, nor very tall, and open glades flanked the banks on each side of the river—in other words, the conditions were quite like those occurring at Sacandaga Park, N.Y., where Protoplasa occurs the most abundantly in this country. I do not recall seeing any rotten logs in the neighborhood, but broken limbs of trees etc., were stranded along the shores, and may have offered breeding places for Protoplasa—which according to Dr. Alexander supposedly breeds in rotten wood.

The entire swarm of Protoplasas "dancing" over the bridge was in reality composed of three more or less distinct groups, one larger group nearer the center of the bridge, and a smaller group nearer each end. The entire swarm must have contained literally hundreds of males, and there were probably several

thousand Protoplasas in the immediate neighborhood, for my capture of one hundred and eighty one specimens did not appreciably diminish the numbers in the swarm, and my scattering the insects by sweeping my net among them seemed to attract others to replenish the swarms which after a few minutes formed again apparently as numerous as before.

The males flew up and down in one general location, rising occasionally to a height of about nine feet, but usually not much higher than one's head, and most of them were flying at about the height of my waist or lower. Now and then a female would dart into the swarm to be instantly seized by a male, and copulation took place in the air. The copulating pairs flew away, and may have settled on the foliage along the banks, but I was too busy collecting material for study, to pay much attention to the few insects I saw copulating! Females were very scarce, and the only one I took in my net (in copula) escaped before I could bottle it—thus indicating that the grip of the male's forceps is not very tenaceous.

Although a torsion of the male genitalia has not been recorded for the Tanyderidae, all of the males of Protoplasa which I have examined from the above-described swarm exhibit a twisting of the terminal segments (involving even the eighth segment to some extent) to such an extent that the parts formerly dorsal may become completely ventral in position. This is evidently in preparation for mating, and has a bearing upon the position of the male during copulation.

All of the captures of Protoplasa that I have made have been near running water, but Dr. Alexander informs me that Protoplasa has been captured at some distance from any stream. I vaguely remember having seen a swarm or two of dark-winged insects that may have been Protoplasa hovering over other bridges than the one in question, but I did not stop to investigate except at the bridge described above.

The points I would especially emphasize are that the supposedly rare "cranefly" Protoplasa may occur in swarms composed of hundreds of males. The females dart into these swarms, and mating takes place in the air. In at least one case such a swarm occurred over a bridge across a shallow rather swiftly flowing river. The insects were swarming just before sunset, and the conditions were much like those encountered at Sacandaga Park, N.Y., in early summer.

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